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P10-1805

Control of paradoxical kinematics in cruciate retaining total knee prosthesis using navigation

Massin P.[*1], Donadio J.[1], Pelissier A.[1], Boyer P.[1]*
[1]Hopital Bichat Claude Bernard, Paris Cedex 18, France

Objectives: Balancing the posterior cruciate ligament in cruciate retaining total knee prostheses aims at restoring the roll back of the femoral condyles. Actually paradoxical displacements often persist. We hypothesized that over sizing the femoral component would facilitate PCL tensioning.

Methods: The kinematics of 21 knees was intraoperatively recorded before and after implantation of a cruciate retaining total knee prosthesis, using a dedicated navigation software. Selection criteria were moderate preoperative misalignments (inferior to 10°) and intact anterior cruciate ligament. Moderate over sizing of the femoral component (one size) was possible without lateral overhanging due to the use of narrow gender designs, while checking the flexion space for the absence of excessive tightening. Furthermore, navigation allowed insert-thickness final adjustment in 10 cases, in which an antero-posterior laxity persisted after implantation of the trial components. A matched paired comparison of the pre- and post-implantation antero-posterior displacements of the femoro-tibial contact points was performed.

Results: The mean posterior displacement of the medial condyle decreased from 9 ± 9 to 1 ± 6 mm after implantation ($p = 0.001$). In the same manner, the mean posterior displacement of the lateral condyle decreased from 16 ± 14 to 6 ± 6 mm after implantation ($p = 0.006$). There was a single case with a 11-mm paradoxical displacement of the medial condyle that already existed preoperatively. The most significant differences concerned the 0°–30° interval of flexion, in which the posterior displacements were divided by two and by four for the medial ($p = 0.001$) and the lateral condyles ($p = 0.004$) respectively. Beyond 90°, the mean course of the lateral condyle decreased from 2 ± 3 to 0 ± 4 mm in the 90°–120° interval of flexion ($p = 0.046$).

Conclusions: Over sizing the femoral component prevented intraoperative paradoxical displacements in 95 % of cases. However, it did not restore the femoral roll back. It remains to be seen if the effect of intraoperative adjustments persists under load during daily activities.

Cruciate retaining total knee prosthesis, Navigation, Paradoxical kinematics

P10-1826

Arthroscopic arthrolysis for arthrofibrosis after total knee replacement: surgical technique and results

Ateschrang A.[*1], Grünwald L.[1], Stöckle U.[1], Schröter S.[1]*
[1]Berufsgenossenschaftliche Unfallklinik Tübingen, Klinik für Unfall- und Wiederherstellungschirurgie, Tübingen, Germany

Objectives: Arthrofibrosis after total knee replacement (TKR) is a painful complication and leads to disability of the patients in daily living. Manipulation under anaesthesia (MUA) is a common technique. However, MUA has major complications risks (fracture of the distal femur and patellar tendon rupture). Open arthrolysis has an extensive approach. Arthroscopic arthrolysis is a challenging technique. A systematic workflow while the procedure supports the success and makes it easier. The aim of the study was to review the functional results after surgery and describe our systematic arthroscopic technique.

Methods: In the retrospective study 26 patients were treated for arthrofibrosis after TKR between 06/2006 and 12/2011 with arthroscopic arthrolysis. Inclusion criteria were: 1. TKR, 2. Arthrofibrosis, 3. Arthroscopic arthrolysis. Exclusion criteria: 1. Exchange of prosthetic components, 2. Septic revision before arthroscopy, 3. Radiological proven malposition or loosening of the prosthetic components. ROM was recorded preoperatively and at time of follow-up. The arthroscopy started with a medial and lateral suprapatellar approach. Instruments were inserted suprapatellar according a rendezvous-procedure. Alternately, the shaver and side-effect electrode were used. After reaching a suprapatellar pouch it was possible to resect the fibre-bands between patella and TKR. The next step was the lateral and medial release. An anterolateral and anteromedial approach in the rendezvous-procedure was performed for debridement the intercondylar notch. Afterwards the lateral and medial release was completed. Due to these surgical steps the damage to the surface of the TKR can be avoided. Immediately after the procedure a continuous passive range of motion was started. Extensive physiotherapy under peripheral nerve block was started at the day after surgery.

Results: The mean age was 63 ± 10 years. The average interval between TKR and arthroscopic arthrolysis was 9.7 ± 8.4 months. The mean preoperative extension deficit was 7° ± 6° and the mean flexion was 68° ± 18°. Intraoperatively the mean flexion was 110° ± 10° and decreased to 91° ± 16° at the time of follow-up. The extension was intraoperatively 2° ± 3° and decreased to 5° ± 7°. Differences in the paired student *t* test were for flexion intraoperatively 41° ± 16° ($p < 0.0001$) and at time of follow-up 20° ± 19° ($p < 0.0001$). 2 complications were recorded, 1 deep thrombosis and 1 infection.

Conclusions: The presented arthroscopic technique for arthrolysis after TKR is save with low complication rate. The excellent intraoperative ROM could not be maintained to the follow-up. We recognized several limitations of the study. It was a retrospective study design and we did not record a clinical score. Nevertheless an improvement of 20° compared to preoperative were recorded. In summery arthroscopic arthrolysis is a beneficial but demanding procedure. Therefore we recommend the arthroscopic arthrolysis with a less invasive approach in cases of arthrofibrosis after TKR.

Arthroscopic arthrolysis, TKR, Arthroscopic technique

P10-1844

Are all-polyethylene tibial components a viable biomechanical alternative in TKAs?

Pianigiani S.[*1], Brilhault J.[2], Navacchia A.[3], Labey L.[4], Pascale W.[5], Innocenti B.[4]*
[1]IRCCS Istituto Ortopedico Galeazzi, Milano, Italy; [2]Faculté de Médicine, Université F. Rabelais, Tours, France; [3]Department of Mechanical Engineering, University of Bologna, Bologna, Italy; [4]Smith & Nephew, European Centre for Knee Research, Leuven, Belgium; [5]I.R.C.C.S. Istituto Ortopedico Galeazzi, Milano, Italy

Objectives: An alternative solution to fixed bearing metal-backed (FMB) tibial components is the all-polyethylene (AP) monoblock tibial insert. The AP solution offers two main benefits in comparison to the FMB: it eliminates the insert-metal interface and it decreases the cost of the arthroplasty. However, this solution presents a mechanical structure that might induce different stress and strain distributions inside the tibial bone and consequent implant micromotions. Up to now, no literature studies investigate and compare the full biomechanical behavior of AP concept with respect to the FMB concept. For these reasons, this study aims to evaluate the stress and strain distribution, using finite element analysis, in FMB and AP tibial components for Total Knee Arthroplasty (TKA) during a high flexion motor task. Moreover, the effect of several cementing techniques and different bone qualities were also investigated.

Methods: A FMB TKA and a FMB UKA and their respective AP configurations were implanted in the same validated tibio-femoral numerical knee model following the appropriate surgical procedures. The loads and constraints during a squat, up to 120°, were applied to

all configurations. For all the configurations, three different cement penetration depths (2, 3 and 4 mm) in the proximal tibia, as well as three different bone qualities (physiological, osteoporotic and osteopenic) were also considered. Bone stresses and implant micromotions were extracted and compared in all the developed models.
Results: When comparing the stress distribution at the implant-bone interface, results show that the FMB configuration distributed the stress in the bone more uniformly and led to considerably reduced stress values in the cancellous bone. The presence of an AP implant induced higher bone stresses (more than 74 %) than the FMB implants in all configurations. Implant micromotions with AP inserts increased up to five times relative to FMB. Bone quality affects both stress distribution and micromotions (up to 72 % for osteoporotic bone) while different thicknesses in cement layers change mainly the micromotions (up to 5 times).
Conclusions: In this study, the biomechanical behaviour of AP and FMB configurations were numerically investigated during a squat motor task. TKA AP tibial components do not exhibit the same mechanical behavior as their respective FMB components, with higher tibial stress and increased implant micromotions. The results demonstrated that FMB tibial components reduced compressive stresses in cement and cancellous bone beneath the baseplate and distributed stress more uniformly on the surface of the tibial proximal cut. Also micromotions in the bone-baseplate interface showed a clear difference between AP and FMB. These results should be considered when selecting the appropriate tibial baseplate option for the patient.
All-poly, Metal back, TKA, Tibial stress

P10-1847

Progression of medial OA and long term results with lateral unicompartmental arthroplasties: 54 cases at minimum 10ys FU

Franck F.[1], Lustig S.[2], Debette C.[3], Servien E.[4], Neyret P.[1]*
[1]Hôpital de la croix rousse, Lyon, France; [2]Centre Albert Trillat, CHU Lyon Nord, Lyon, France; [3]Centre Albert Trillat, Lyon, France; [4]Lyon University, Centre albert Trillat, Lyon, France

Objectives: The literature results of unicompartmental knee arthroplasty (UKA) for isolated lateral arthritis are not as good as isolated medial arthiritis. In 1988 our department started using a UKA with a fixed all polyethylene bearing and resurfacing of the distal femoral condyle. The aim of this retrospective study was to report on the progression of medial OA and long term results with this implant for isolated lateral osteoarthritis at a minimum follow up of 10 years.
Methods: From January 1988 to October 2003, we performed 54 consecutive lateral UKAs (36 %) in 52 patients. Only patients that conformed to our selection criteria were chosen. All patients had isolated lateral osteoarthritis (3 cases post-traumatic osteoarthritis). The mean age of the patients at the time of the index procedure was 72.2 ± 1.5 years. Forty-seven UKAs (45 patients) were available for follow up. The minimum duration of follow-up was 10 years and maximum 18 years. The mean duration of follow-up was 14.2 years (range 122–216 months).
Results: At follow up 7 had undergone a second operation; 6 developed medial compartment osteoarthiritis (3 medial UKA and 3 conversion to TKA) and one was converted to TKA for tibial tray malpositionning. No revision surgery was necessary for wear or infection or progression of PF OA. The mean IKS knee score was 95 points and mean IKS function score was 82 points. The mean range of motion was 132.6° (range 115–150). Implant survival was 93.5 % at 10 years and 90.7 % at 15 years.
Conclusions: The use of a UKA with fixed bearing and a femoral resurfacing implant is a reliable option for the management of isolated lateral knee osteoarthritis. We have demonstrated excellent functional results and implant survival in the long term. The only remaining issue is the progression of medial OA.
Knee, Arthroplasty, External UKA

P10-1946

Unicompartimental lateral knee arthroplasty using the robotic arm system

Franceschi G.[1], Bertolini D.[1], Khabbazè C.[1], Rovini A.[1], Nardacchione R.[1]*
[1]Policlinic of Abano Terme, Abano Terme, Italy

Objectives: Isolated lateral compartment osteoarthritis (OA) occurs in 5–10 % of knees with OA [1, 2]. Lateral unicompartmental knee arthroplasty (LUKA) emerged as a treatment to this disease in the early 80s but challenging surgical technique has limited the prevalence of this treatment option [1–3]. A robotic-arm assisted surgical technique (MAKO Surgical Corp.) has emerged as a way to achieve precise implant positioning which can potentially improve surgical outcomes.
The purpose of this study was to evaluate short term outcomes for patients that received LUKA using a novel robotic-arm assisted surgical technique.
Methods: Thirty-seven (37) patients (12 male, 25 female—mean age 63.7 years) with lateral OA received a robotic-arm assisted LUKA between July 2011 and September 2013 from 3 surgeons. All patients were evaluated by an independent surgeon not involved in the treatment of these patients at an average follow-up of 15.9 months (8–27). Range of motion and limb alignment was compared pre- and post-operatively.
Results: Lateral UKA using robotic-arm assistance improved the post-operative range of motion an average of 4.8 ± 7.1° ($p < 0.0001$) from a starting value of 136.5 ± 8.6° to a post-operative value of 141.6 ± 8.0°. In addition, patients began with a pre-operative deformity of 3.1 ± 3.2° of valgus and resulted in a post-operative alignment of 0.8 ± 1.9° of valgus corresponding to an average correction of 2.4 ± 2.3° less valgus ($p < 0.000001$). The average operative time was 44.0 ± 10.8 min with 97 % of the cases completed within 60 min.
Conclusions: These results suggest that LUKA with robotic-arm assistance provides excellent post-operative alignment and demonstrate a reliable option for management of isolated lateral knee OA.
Lateral osteoarthritis, Lateral unicompartimental arthroplasty

P10-1951

Evaluation of joint kinematics and patella tracking in different replacement scenarios with a modular partial knee prosthesis

Calliess T.[1], Ettinger M.[1], Becher C.[2], Ostermeier S.[1]*
[1]Medizinische Hochschule Hannover, Orthopädische Klinik, Hannover, Germany; [2]Medizinische Hochschule Hannover, Department Knie-, Schulter-und Sportorthopädie, Hannover, Germany

Objectives: In the recent years modular partial knee prosthesis with the opportunity to combine unicompartimental medial and patello-femoral replacement were introduced as an alternative treatment strategy for patients with bicompartimental osteoarthritis. However, little is known about the kinematics of these modular bi-cruciate retaining designs and especially about the influence on the patella tracking and joint kinematics. Purpose of this in vitro study was to evaluate the effect of different replacement scenarios with a modular partial knee replacement system on the amount of quadriceps force required to extend the knee during an isokinetic extension cycle and on the resulting patello-femoral contact kinematics.
Methods: Eight human knee specimens were tested in a in vitro kinematic knee simulator under (1) physiologic condition and after subsequent implantation of (2) a medial unicondylar and (3) a trochlear replacement. An isokinetic extension cycle of the knee with a constant extension moment of 31 Nm was simulated. The resulting quadriceps extension force, the retropatellar contact pressure and the patello-femoral tracking was evaluated from 120° to full knee extension.